

Sustainability: a Strategic Design issue for Product-Service-Systems.

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The world is moving towards the complex situation for survival. Increasing environmental pollution, over population growth, increasing rate of consumption and use of natural resource material etc are creating an unsustainable situation for the human being. Also the western model of development cannot be a viable solution for the rest of the world.

The in-equal distribution of resource material, as 20% of the world population is enjoying consumption depriving the rest 80% of population, creates an unbalanced socio-political as well as economical situation among the society. So sustainable lifestyle is becoming a challenge for the design field.

Many methods have been applied, but Product-Service Systems can be a promising way of design to tackle the situation of un-sustainability and make a sustainable world. Based on activity theory, Product-Service-Systems can dematerialise the consumption pattern of consumers towards sharing of product culture through services.

List of Key words: Sustainability, Product-Service Systems (PSS), Strategic Design, Dematerialised consumption.

Introduction: a problem

Through out the world, we can observe many inequalities around our neighbourhood, in dealing with daily life consumption and standard of life-style. Lots of misconception leads to unsustainable production and consumption in the society.

For 200 years, after Industrial Revolution, the Industrial economy only tried to optimise the production process in order to reduce the unit costs of scarce resource materials from production to point-of-sale, to maintain the efficiency of process technologies and better quality of goods. Technical research is still concentrated on progress of production process rather than utilisation, which has only led to the increase of efficiency of labour productivity. It was only possible because of low cost of basic resource material, energy etc in comparison to other production factors like Labour economy. According to Robert Ayers, about 94% of materials extracted for use in the manufacture of durable products became waste before the product was even completed.

=> **Zero-life products** =>

Resources => Base materials => Manufacturing => Point-of-sale => Utilisation => Waste

Fig 1. *The linear structure of Industrial (or 'river') economy.* Source: Stahel and Reday 1976.

Also according to W. Stahel, the parts of goods that go directly from production to disposal (zero-life products) has reached 30% in some sectors. See Fig 1.

Over use of non-renewable energy and resource exploitation to run the Industrial economy and to reach the high levels of production and consumption, has generated global environmental problems. For example, Transport is responsible for up to 70% of all CO₂ emissions. Huge investment made in end-of-pipe equipments and cleaner and smarter technologies to minimise environmental pollution and increase resource productivity did not really leads to drastic minimisation of overall environmental impacts, because it increases rate of consumption, which is driven by economies of scale, leading to another “Rebound Effect” according to Prof. Ezio Manzini.

According to the estimation, the World population will be almost double by 2025, which will again demand an increase in resource consumption. If it is tried to follow the exponential growth of 5-6% for Developing countries and 3-4% for Developed countries according to Burndtland Report, then the Earth will not be able to sustain such a huge growth. On the other hand, one-fifth of the world population in the rich countries of North consume four-fifth of world resources. If Developing countries were to attain Northern life-style, material flows would grow five fold. Taking into account the expected growth in population, this would translate into eight times the current global material flows by the year 2040. Such a growth in materials use and dissipation would probable place an insupportable strain on natural life support systems (Schmidt-Bleek, 1994).

The demand of a good quality of life from the Developing countries is quiet logical, where as a strict restriction on the consumption pattern needs to be implemented on the Developed countries following a Factor of 20, i.e. how to consume with a twentieth of the current environmental burden. It assumes a doubling in World population, a five-fold per capita increase in consumption (especially in Developing countries) and a halving of the environmental burden.

There is a need to unlink the relation between wealth, life-style, personal development as well as economic prosperity and over consumption of natural resource materials. The environmental damage caused by the poverty of Developing countries and the over consumption of Developed countries should be distinguished through proper way.

Sustainability: a strategic target

The concept of Sustainability deals with many facts and figures keeping in mind of the three main aspects of any production and consumption activity i.e. Environmental, Economic and Social aspects. Even the Industrial economy itself is not compatible with the aims of Sustainable society. It is a short term commitment of production and consumption with flow of resource material up to point-of-sale. Where as a Sustainable economy takes the responsibility of the waste materials cycle and tries to maintain the higher level of resource productivity, i.e. a need to reduce the resource flow by a Factor of 10 for the Developed countries and to enable the Developing countries to increase the per capita resource input within the sustainable limit of production and consumption. More emphasis is given on the result-focused economic growth based on social and cultural values for a sustainable society. So the economy must be able to produce the same utilisation value out of a greatly reduced resource throughput, which is observed in Service economy.

A transition from Industrial economy to Service economy leading to sustainable society is only possible if the whole population may agree on a common vision of sustainability, where it will be derived by cultural ecology rather than technology driven economy. According to W. Stahel, the milestones of strategies and policies those we have already achieved or yet to achieve through various institutions, to lead a sustainable society, are given in Table 1.

Table 1. *The five pillars or stepping stones, of sustainability, and the first and second borderline*

1. Nature conservation (precautionary principle);
2. Health and safety, non-toxicity (qualitative);
- the first border line: from protecting the environment (doing things right) to increased economic competitiveness (doing the right thing)**
3. Increased resource productivity (reduced throughput, quantitative);
- the second border line: from a sustainable economy to a sustainable society**
4. Social ecology (jobs and wants, sharing and caring);
5. Cultural ecology (the choice between sufficiency and efficiency).

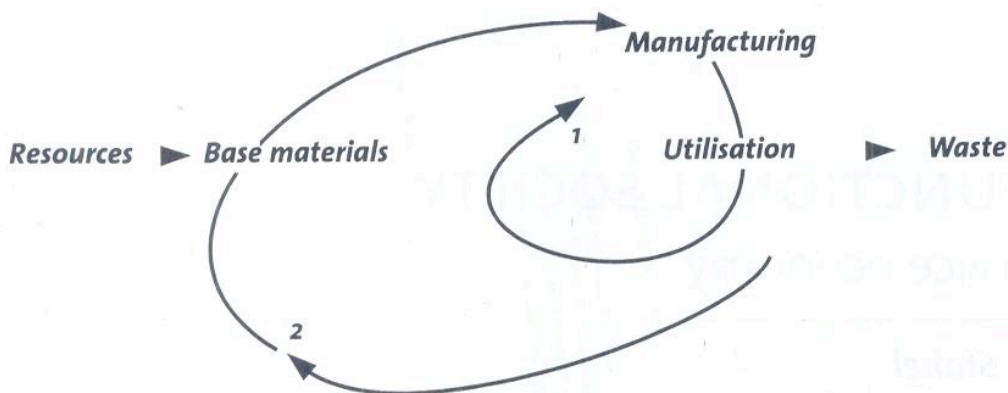
Source: The Product-Life Institute, Geneva

From protecting the environment to increasing the economic competitiveness through increasing the quality of health, safety and non-toxic environment, already achieved by Developed nations and in process in some Developing countries.

Again increasing resource productivity is a transition from Industrial economy to sustainable economy. However, the policies those are to be implemented to achieve the higher resource productivity still not accepted by the policy makers in many societies. De-coupling the corporate success and GDP from resource consumption, new rules and regulations to allow innovation strategy in the free market competition, innovative research more towards utility focused than cleaner and smarter technology focused, proper distribution of knowledge economy with the help of new legal framework and network are very much required in the more sustainable economy. Higher resource productivity can be achieved through means of more sustainable consumption i.e. from eco-efficiency to a sustainable society through changing social and cultural ecology.

The social and cultural ecology, are rooted in regional structures and require tolerance and the principle of regional subsidiarity. The driver of the sustainable society will be people's desire, which can have various cultural frames, but based on a common vision of sustainability.

Junction 1: product-life extension versus new goods (cost advantage product-life extension)



Junction 2: virgin materials versus recycling materials (cost advantage virgin materials)

Loop 1: Re-use of goods, Repair of goods, Reconditioning of goods, and Technological or fashion upgrading of goods *Loop 2: Recycling of materials*

Fig 2. *Closing the material loops: the loops of a self-replenishing, more sustainable service (or 'lake') economy, and the junctions between these loops and a linear economy*

Source: Stahel and Reday 1976

According to W. Stahel, if the manufacturers are forced to recycle, Fig 2 explains why the free market prefers Junction 2 to economically advantageous Junction 1. Because of lack of national legislation calling for liability loops (which are 'invisible') and closed material loops and the familiarity of throughput optimisation to manufacturers, it is easier to forget the responsibility in a technology-focused approach.

Working only on a particular project of the society to solve the problems keeping in mind of sustainable vision is a hard job as it is required to close the total system working and a new start of the total socio-technical systems. Because every human system is connected to another human socio-technical and cultural systems.

Product-Service Systems (PSS): a way towards sustainability

The main stress in Service economy is on utilization of product to increase the total wealth and welfare with minimum flow of resource material and increase in quality through long-term optimisation of system functioning. Therefore, Product-Service Systems have the potential to minimise the environmental impact due to over consumption, over population and over flow of resource material, towards emerging Functional economy.

A marketable set of products and services capable of jointly fulfilling a user's need, Product-Service Systems (PSS) has a varying ratio of products and services according to functional fulfilment or economic value. Both users and service providers are required at the same time as the PSS production and consumption is done simultaneously, which cannot be stored for the future, like the products in the store.

Product-Service Systems is the combination of a heterogeneous mix of elements like people, cultural frames and technological artefacts, which suggests that the designer of PSS must have the same function as engineer-sociologist described by Callon. Emphasis is given on the social, technological and cultural frames of the actors participating in the development of the system and the technological knowledge embedded in the artefacts used for the service, in order to consider the acceptance or rejection of certain products and technologies by relevant social groups. The cultural frames are intelligible through the physical and technological characteristics of the artefacts.

Various approaches are adopted towards the development of PSS, like sale of utility of products instead of selling of products, leasing business activity, repair or remanufacturing of products and reuse, substitution of products by means of service business.

The utility however has to be investigated through market research. Introducing PSS requires communicating and providing information to 'new' stakeholders. Thus, the producers or the service providers, extend their interest beyond their usual boundaries, in terms of both product life cycle phases and connections with other products and services, which, taken together, will result in an integrated solution for the customer.

Strategic Design: a characteristic approach

Prof. Ezio Manzini proposes the idea of Strategic Design as a new approach for companies to engage in an increasingly "turbulent" market. Strategic Design focuses on the design process on an integrated body of products, services and communications, as a model for companies to address changes in technology and social and consumer attitudes.

The designer has a role of strategic thinking in dealing with corporate strategies and policies towards sustainable solutions. Strategic thinking and action in the form of creativity and capacity to respond to unforeseen-events must therefore be cultivated at all levels of the organisation. This creativity must be contextual and ecological – social creativity. According to Banathy, design is a journey of creation. It is

a journey toward a desired future state, which we define for ourselves and want to realise. The metaphor of the journey allows us to see design as a method by which we can move from the present to a future situation that is preferred to the present. This is a re-thinking of strategy as a relationship to the future, and as a process – a journey. Strategy as design is also viewed as a journey of creation – and as a creative process.

Comparing realism versus idealism, design attempts to transcend the two opposing positions. Realists focus on describing what is, and developing theories, approaches, and strategies on the basis of the description; idealists focus on what ought to be, and plan on the basis of their ideals. The dichotomy ensures that realists are unlikely to go beyond existing conceptual frameworks and explore what could be, let alone what should be, whereas idealists often fail to ground their strategies in a ‘realistic’ assessment in a given situation. The fundamental assumption is that the environment is by no means fully knowable, and a plurality of descriptions can give us a “rich picture” that can allow for a deeper understanding of the situation.

Design explores future alternatives based on an understanding of what ought to be, and lets these images guide the design process. The designer works back from these ideal images to see what potential obstacles might exist to their realisation. A different approach to realism and idealism emerges, one that is based on a synthesis of a different, contextualised, dialogical understanding of the real and the ideal. Design is therefore a method of disciplined inquiry which, among other things, allows us to

- (a) explore our present position,
- (b) gain an understanding of our values and assumptions and how they affect both our view of the present situation and of our aspirations for the future,
- (c) characterise our ideals concerning the future system we wish to develop, and
- (d) allow us to develop a map or model of how we can get to the future state.

Design proceeds from outside-in rather than inside-out: this is a crucial difference, which distinguishes design from planning. Inside-out inquiries start from within the planner’s already existing conceptual and empirical boundaries. It is information-driven, because the inquiry is based on already existing information rather than value-driven. This means it occurs based on information derived from the perspective of already existing conceptual frameworks in which values are implicit (“inside”), and there is no attempt to engage in a questioning of those fundamental values themselves. Value-driven, outside-in design starts with an articulation of our present situation in which our values concerning our assessment of the situation are made explicit, and the values inspire us to design a future system that conforms to those values. The stress is on articulating values, and fostering creativity.

Design is a creative, decision-oriented disciplined inquiry that aims to formulate expectations and requirements of the system to be designed, clarify ideas and images of alternative representations of the future system, devise criteria by which to evaluate those alternatives, select and describe or “model” the most promising alternatives, and prepare a plan for the development and implementation of the selected model.

Design is a systemic process: it is not a linear, step-by-step process which separates components in a chain of cause and effect, and focuses on the smallest unit of analysis by removing it from its context. It is rather a process of inquiry that stresses the importance of the context one works in, the context in which the present system operates, and in which the future system will emerge.

Design is also creative process: emphasis is placed on developing an alternative, or a series of alternative solutions, to an existing problem situation. Design assumes that there are many different ways of creating a model, and many different models, which can emerge from design. In design, an inductive model is created, which is “a representation of a system that does not yet exist but is intended to be built”. Design is creative in the sense that it does not develop a model by merely

shuffling around components of an already existing system within the parameters defined by that system, but attempts to change or reconceptualize the nature of the system itself.

The creative dimension of design is “the dynamics of divergence-convergence,” in which “the designer continually goes through alternating sequences of generating variety (divergence) and reducing variety (convergence), while seeking the single most feasible and workable alternative”.

Discussion & conclusion:

Now coming to the Strategic Design issues dealing with Product-Service Systems area targeting sustainability, we take the example of “washing cloths” provided by the UNEP. We can understand that there are various existing solutions like, leasing the washing machine for washing purposes, buying washing services from the company directly or taking the cloths to the washing area and clean them as self-service with the help of company-enabled setup. But the most feasible and workable solution targeting sustainability issue can be according to the user’s desire, considering the sustainable sufficiency level of consumption.

As Strategic Design is an outcome of implicit knowledge that only can be expressed through the creation of Product-Service Systems scenario kind of explicit knowledge. People’s participation is very much required as it is also a social innovation in reality. And because of the problems generated by over consumption, population, scarce resource material and environmental pollution, Strategic Design can visualise the future dematerialised consumption world with the help of the tools like Product-Service Systems towards Functional economy.

Sustainable production and consumption activity, for Strategic Design, is a total sea change target in production and consumption pattern through out the world, as it is the change in perception of network of the stakeholders, producers, users, communication etc, a transition from the present link between social status of user and material consumption world. Following the theory of knowledge creation, Strategic Design continuously work for increasing quality of Product-Service Systems at the local level through various steps like Socialisation, externalisation, combination and internalisation (see Fig 3)

		Result	
		<u>Implicit knowledge</u>	<u>Explicit knowledge</u>
Basis	<u>Implicit knowledge</u>	<i>socialization</i>	<i>externalization</i>
	<u>Explicit knowledge</u>	<i>internalisation</i>	<i>combination</i>

Fig 3. Contents of knowledge and four modes of
Source: Nonaka / Takeuchi 1995

with the flow of information about users’ feedback and application of it into design of Product-Service Systems. So creation of jobs at the local level is very much done by the Strategic Design through PSS application in the Dematerialised Functional economy.

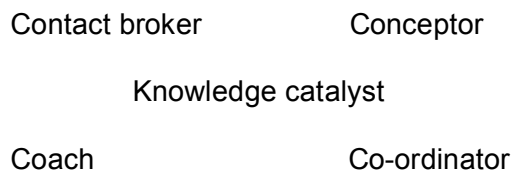


Fig 4. Balance of roles in Design management

In this whole process of Product-Service Systems design, the Strategic Designer work as Contact broker, Conceptor, Co-ordinator, Coach and Knowledge catalyst to facilitate new generation of ideas with the help of the network of stakeholders, user, ICT providers.

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